while drying conditions can degrade heat-sensitive antioxidants or, when optimized, improve retention of chlorogenic acid, luteolin, total phenolics, total flavonoids, and volatiles. Safety quality indicators should therefore include heavy metals, microbial contamination, and other routine safety tests in addition to active components, because chrysanthemum tea evaluation commonly measures cadmium, lead, tin, mercury, arsenic, total plate count, coliforms, and molds (Keliat et al., 2026).

5.3 Identification of critical quality control points

Critical quality control points for Hangzhou White Chrysanthemum should be identified by following the chain from origin and seedlings to harvest, drying, storage, and final authentication, because chrysanthemum quality is formed cumulatively rather than at a single stage (Yao et al., 2023). The first control point is origin and seedling consistency, since growth environment affects quality and sale price, soil mineral signatures influence active compounds, and reasonable seedling classification standards improve subsequent plant quality (Long et al., 2023; Jing et al., 2024). The second control point is cultivation-input regulation, since agronomic measures can change both nutritional and medicinal indices, sometimes increasing yield while slightly reducing some medicinal constituents, though remaining above Pharmacopoeia standards (Zhang et al., 2023). The third control point is harvest stage, because harvest time affects inflorescence diameter and active-ingredient accumulation, and chlorogenic acid can peak in late-bud or early bloom before declining during fuller flowering and senescence (Neatpatiparn et al., 2025).

The fourth and fifth control points are processing and post-processing management, because drying, kill-green treatment, packaging, and storage all alter quality and safety. Drying is a crucial post-harvest step, and optimized drying or pretreatment can improve retention of phenolics, flavonoids, volatiles, and antioxidant capacity, whereas prolonged or poorly controlled heating can degrade heat-sensitive compounds (Yang et al., 2025; Keliat et al., 2026). Fingerprint similarity, batch similarity analysis, and Q-marker quantification are suitable tools for judging whether processed batches remain within an acceptable quality range, since commercial chrysanthemum batches can vary substantially even within the same accession. The final control point is traceability-enabled authenticity verification, because origin misidentification and fragmented supply chains weaken quality assurance, while IoT-based numbering and whole-process traceability improve supervision from planting through processing and sale (He and Shi, 2021). Accordingly, the key control indicator set for Hangzhou White Chrysanthemum should integrate appearance grading, basic physicochemical indices, marker compounds, safety tests, fingerprint consistency, and full-batch provenance, so that quality evaluation can support both green production management and reliable traceability in the market.

6 Information Management and Application of the Quality Traceability System for Hangzhou White Chrysanthemum

6.1 Traceability coding and QR code-based information management

The traceability coding system for Hangzhou White Chrysanthemum should use a unique batch identity that follows the product from cultivation through packaging and sale (He and Shi, 2021). Existing agricultural systems commonly encode product ID, batch number, harvest date, processing date, supplier identity, storage conditions, and a blockchain record link, which provides the core data structure for reliable lifecycle tracking. A hierarchical coding structure is also practical, because upstream material, planting, harvest, storage, and packaging nodes can be split into subcodes that preserve process detail without breaking batch continuity.

QR codes are suitable as the consumer-facing carrier of this coding system, because they allow direct inquiry of traceability information from raw material to finished product (Jing and Li, 2024; Sonawane, 2025). In herbal systems, QR codes can carry not only identity data but also quality data, including chemical-fingerprint information that can be read by smartphone applications and compared across batches. Dynamic QR codes further improve communication because the displayed information can be updated, shared, and integrated into social platforms, making the code part of both supervision and brand sales.